TRANSMITTAL FORM

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Total Number of Pages in This Submission	34	Application Number	09/899,852
		Filing Date	July 9, 2001
		First Named Inventor	Eilon RIESS, et al
		Art Unit	2123
		Examiner Name	K. Thangavelu
		Attorney Docket Number	12805/46002

ENCLOSURES *(check all that apply)*

- [ ] Fee Transmittal Form
  - [ ] Fee Attached
- [ ] Amendment / Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
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- [ ] Certified Copy of Priority Document(s)
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  - [ ] Reply to Missing Parts under 37 CFR1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (**Appeal Notice, Brief, Reply Brief**)
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) *(please identify below)*:

1) Issue Fee Transmittal
2) Designation of Fee Address
2) Comments on Statement of Reasons for Allowance and two attachments

Remarks

Applicant claims small entity.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm	Kenyon & Kenyon LLP		
Signature	*[signature]*		
Printed Name	Robert L. Hails, Jr.		
Date	June 9, 2006	Reg. No.	39,702

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below.

Signature			
Typed or printed name		Date	

PATENT
Att'y Dkt.: 12805/46002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Confirmation No. 6076
Eilon RIESS, et al.	Examiner: K. Thangavelu
Serial No.: 09/899,852	
Filed: July 9, 2001	Art Unit: 2123
For: Reliable Symbols as a Means of Improving the Performance of Information Transmission Systems	

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

Mail Stop: ISSUE FEE
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P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

With respect to the Notice of Allowance in the above-identified application and the Examiner's Statement of Reasons for Allowance, the Statement fails to note that the amendments entered by examiner's amendment were accepted by Applicants based on a common understanding of the term "high order constellation." The understanding was established in discussions with the Examiner in related cases, U.S. App. No. 09/836,281 and U.S. App. No. 09/899,844, and were continued in the discussions in the above-referenced application. See, attached exhibits. As agreed to by the Examiner and Applicants, "high order constellation" shall be interpreted to mean transmission constellations having more than two constellation points (See also, specification, ¶ 6). No acknowledgement appears in the Notice of Allowance and, therefore, this paper corrects the oversight.

If you have any questions, the Examiner is invited to contact the undersigned at (202) 220-4235.

Respectfully submitted,

Date: June 9, 2006

Robert L. Hails, Jr.
Registration No. 39,702

KENYON & KENYON LLP
1500 K Street, N.W.
Washington, D.C. 20005
Ph.: (202) 220-4200
Fax.: (202) 220-4201

Browne, Beverly

From: Hails, Robert
Sent: Friday, February 03, 2006 2:19 PM
To: 'Kandasamy.Thangavelu@uspto.gov'
Cc: Browne, Beverly
Subject: RE: Appl'n sn 09/836,281
Attachments: IDS for 46001.pdf

Examiner Thangavelu:

I spoke with my client and have obtained authorization to enter the amendments sent yesterday to you only if it will achieve an allowance of the application. Please note the explanation of high order constellation in the remarks.

Also, please note that we filed an IDS in this application which corresponds to the references you cited in the other two related cases. I've attached a PDF copy of our IDS for your convenience.

Regards,

Bob Hails

From: Hails, Robert
Sent: Thursday, February 02, 2006 1:10 PM
To: 'Kandasamy.Thangavelu@uspto.gov'
Subject: Appl'n sn 09/836,281

Examiner Thangavelu:

I transcribed the amendments you requested in the attached document. Please review it with your supervisor. I will send them to my client this evening.

Regards,

Bob Hails

Robert L. Hails
Kenyon & Kenyon, LLP
1500 K Street, N.W.
Washington, D.C. 20005

O: +1 202 220 4235
F: +1 202 220 4201
RHails@Kenyon.com

PROPOSED CLAIM CHANGES – SN 09/683,821

1. (Currently Amended) A reliable symbol identification method for use in a communication system for transmitting symbols of a high order constellation, comprising:

calculating a reliability factor of a captured sample from values of a plurality of other samples in proximity to the captured sample, wherein the captured sample and the plurality of other samples represent a data signal recovered from a communication channel, and

if the reliability factor is less than a predetermined limit, designating the captured sample as a reliable symbol.

2. (Previously Presented) The method of claim 1, wherein the reliability factor R_n of the captured sample is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} |y_{n-i}| \cdot c_i \text{ , where}$$

y_n is the captured sample,

y_{n-i} is a sample in proximity to the captured sample,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

3. (Original) The method of claim 2, where $c_i = 1$ for all i.

4. (Original) The method of claim 2, wherein $K_1 = 0$.

5. (Original) The method of claim 2, wherein $K_2 = 0$.

6. (Currently Amended) The method of claim 1, wherein the predetermined limit varies over time.

7. (Currently Amended) The method of claim 1, further comprising determining a rate at which reliable symbols are identified, and

if the rate is less than a predetermined value, increasing the predetermined limit.

8. (Currently Amended) The method of claim 1, further comprising determining a rate at which reliable symbols are identified, and

if the rate exceeds a second predetermined value, decreasing the predetermined limit.

9. (Previously Presented) The method of claim 1, wherein the reliability of a two-dimensional captured sample y_n is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i\neq 0}}^{K_2} \sqrt{y_{1_{n-i}}^2 + y_{2_{n-i}}^2} \cdot c_i \text{ , where}$$

$y_{1_{n-i}}$ and $y_{2_{n-i}}$ ~~$y_{1_{n-i}}^2$ and $y_{2_{n-i}}^2$~~ respectively represent values of a neighboring sample y_{n-i} in first and second dimensions,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

10. (Currently Amended) A method of identifying reliable symbols for use in a communication system for transmitting symbols of a high order constellation, comprising:~~,~~

for a captured sample y_n recovered from a communication channel:

iteratively, for i= $-K_1$ to K_2, $i\neq 0$, wherein K_1, K_2 are real numbers:

adding to a reliability factor a value of based on another captured sample y_{n-i} also recovered from the communication channel,

if the reliability factor exceeds a predetermined limit, disqualifying the captured sample as a reliable symbol, ~~and~~

otherwise, incrementing i and, if i=0, re-incrementing i for a subsequent iteration; and

thereafter, unless the captured symbol has been disqualified, designating the captured sample as a reliable symbol.

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11. (Previously Presented) The method of claim 10, wherein the adding adds an absolute value of the sample y_{n-i} to the reliability factor.

12. (Previously Presented) The method of claim 10, wherein the adding adds a scaled value of the sample y_{n-i} to the reliability factor, the value scaled in accordance with a ~~predetermined~~ coefficient c_i representing any prior knowledge of intersymbol interference effects.

13. (Previously Presented) The method of claim 10, wherein the adding adds the power of the sample y_{n-i} to the reliability factor.

14. (Previously Presented) The method of claim 10, wherein the predetermined limit is half a width of an annular constellation ring in which the captured sample is observed.

15. (Previously Presented) The method of claim 10, wherein the predetermined limit is $(K_1 + K_2)d_{min}$ where d_{min} is half a distance between two constellation points that are closest together in a governing constellation.

16. (Previously Presented) The method of claim 10, wherein the predetermined limit varies over time.

17. (Previously Presented) The method of claim 10, further comprising determining a rate at which reliable symbols are identified, and

if the rate is less than a predetermined value, increasing the predetermined limit.

18. (Previously Presented) The method of claim 10, further comprising determining a rate at which reliable symbols are identified, and

if the rate exceeds a second predetermined value, decreasing the predetermined limit.

19. (Currently Amended) A method of identifying reliable symbols, for use in a communication system for transmitting symbols of a high order constellation, comprising: ~~,~~

for a captured sample recovered from a communication channel,

determining whether any value of a plurality of neighboring samples also recovered from the communication channel is within a predetermined limit, and

if none of the values exceed the predetermined limit, designating the captured sample as a reliable symbol.

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20. (Original) The method of claim 19, wherein the predetermined limit varies over time.

21. (Original) The method of claim 19, further comprising determining a rate at which reliable symbols are identified,

if the rate is less than a predetermined threshold, increasing the predetermined limit.

22. (Original) The method of claim 21, further comprising, if the rate exceeds a second predetermined threshold, decreasing the predetermined limit.

23. (Currently Amended) The method of claim 19, wherein the plurality of neighboring samples occur in a first window adjacent to the captured sample on one side of the captured sample.

24. (Currently Amended) The method of claim 19, wherein the plurality of neighboring samples occur in a pair of windows that are adjacent to, and on either side of the captured sample.

25. (Currently Amended) A method of detecting reliable symbols within a sampled data signal, for use at a receiver of a communication system for transmitting symbols of a high order constellation, comprising:

identifying a sequence of sample values having values within a predetermined limit, and designating a sample adjacent to the sequence as a reliable symbol.

26. (Original) The method of claim 25, wherein the predetermined limit varies over time.

27. (Original) The method of claim 25, further comprising determining a rate at which reliable symbols are identified,

if the rate is less than a predetermined threshold, increasing the predetermined limit.

28. (Original) The method of claim 27, further comprising, if the rate exceeds a second predetermined threshold, decreasing the predetermined limit.

29. (Previously Presented) A data decoder for use in a communication system for transmitting symbols of a high order constellation, comprising:

a reliable symbol detector to detect reliable symbols from a sequence of captured samples, the reliable symbols being the captured samples which are estimated to be located in a correct decision region of a corresponding source symbol, ~~have been corrupted least by intersymbol interference ("ISI"),~~

an adaptation unit coupled to the reliable symbol detector to generate intersymbol interference ("ISI") metrics based on the reliable symbols, and

a data decoder to receive the captured samples and estimated source symbols based on the ISI metrics.

30. (Currently Amended) An equalization method for use in a communication system for transmitting symbols of a high order constellation, comprising

identifying reliable symbols from a string of captured samples recovered from a communication channel, the reliable symbols being the captured samples which are estimated to be located in a correct decision region of their corresponding source symbols, ~~have been corrupted least by effects of the communication channel,~~

calculating ~~the~~ channel effects based on the reliable symbols and samples adjacent thereto,

correcting the captured samples based on the calculated channel effects to equalize the string of captured samples.

31. (Currently Amended) The method of claim 30, wherein the identifying comprises:

calculating a reliability factor of a captured sample from values of a plurality of samples in the neighborhood of the captured sample,

if the reliability factor is below a predetermined limit, designating the captured sample as a reliable symbol.

32. (Currently Amended) The method of claim 31, wherein the reliability factor of the captured sample y_n is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i\neq 0}}^{K_2} |y_{n-i}| \cdot c_i \text{, where}$$

y_{n-i} is a sample in the neighborhood of the captured sample,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

33. (Currently Amended) The method of claim 31, wherein the reliability factor of the captured sample y_n is given by:

$$R_n = \sum_{i=1}^{K} |y_{n-i}| \cdot c_i \text{, where}$$

y_{n-i} is a sample in the neighborhood of the captured sample,

K is a length of samples, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

34. (Currently Amended) The method of claim 31, wherein the reliability of a two-dimensional captured sample y_n is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i\neq 0}}^{K_2} \sqrt{y_{1_{n-i}}^2 + y_{2_{n-i}}^2} \cdot c_i \text{, where}$$

$y_{1_{n-i}}$ and $y_{2_{n-i}}$ $\cancel{y_{1_{n-i}}^2}$ ~~and~~ $\cancel{y_{2_{n-i}}^2}$ respectively represent values of a neighboring sample y_{n-i} in first and second dimensions,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

35. (Original) The method of claim 30, wherein the identifying comprises:

identifying a sequence of samples having received signal magnitude levels below a predetermined limit, and

designating a sample adjacent to the sequence as a reliable symbol.

36. (Original) The method of claim 30, wherein, for QAM transmission, the identifying comprises:

identifying a sequence of samples for which a received signal magnitude in a quadrature-phase component is below a predetermined limit, and

designating an adjacent sample as a reliable symbol for quadrature-phase.

37. (Original) The method of claim 30, wherein, for QAM transmission, the identifying comprises:

identifying a sequence of samples for which a received signal magnitude in an in-phase component is below a predetermined limit, and

designating an adjacent sample as a reliable symbol for in-phase.

38. (Original) The method of claim 30, wherein the calculating estimates K channel coefficients a_i according to a least squared error analysis of $y_{RS} - \hat{x}_n - \sum_{i=1}^{K} \hat{a}_i \hat{x}_{n-i}$, solving for $\hat{a}_i$, for a plurality of reliable symbols y_{RS}, where $\hat{x}_n$ and $\hat{x}_{n-i}$ are estimated transmitted symbols.

39. (Original) The method of claim 30, further comprising assigning weights among the reliable symbols based upon respective reliability factors.

40. (Previously Presented) An equalizer, for use in a communication system for transmitting symbols of a high order constellation, comprising:

a buffer memory,

a reliable symbol detector in communication with the buffer memory, the detector to estimate which samples from a sequence of captured samples are located in a correct decision region of their corresponding source symbols, ~~have been corrupted least by channel effects,~~

an adaptation unit in communication with the reliable symbol detector to estimate channel effects based on the values of the reliable symbols and samples adjacent thereto, and

a symbol decoder in communication with the adaptation unit and the buffer memory.

41. (Currently Amended) The equalizer of claim 40, wherein the reliable symbol operates according to a method, comprising:

calculating a reliability factor of a captured sample from values of a plurality of samples proximate to the captured sample, and

if the reliability factor is less than a predetermined limit, designating the captured sample as a reliable symbol.

42. (Currently Amended) The equalizer of claim 41, wherein the reliability factor R_n of the captured sample is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} |y_{n-i}| \cdot c_i \text{, where}$$

y_n is the captured sample,

y_{n-i} is a sample in proximity to the captured sample,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

43. (Currently Amended) The equalizer of claim 41, wherein the reliability of a two-dimensional captured sample y_n is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} \sqrt{y_{1_{n-i}}^2 + y_{2_{n-i}}^2} \cdot c_i \text{, where}$$

$y_{1_{n-i}}$ and $y_{2_{n-i}}$ ~~$y^2_{1_{n-i}}$ and $y^2_{2_{n-i}}$~~ respectively represent values of a neighboring sample y_{n-i} in first and second dimensions,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

44. (Previously Presented) A receiver, for use in a communication system for transmitting symbols of a high order constellation, comprising:

a demodulator to sample and capture transmitted data from a channel,

a buffer memory in communication with the demodulator to store values of captured samples,

a processor executing instructions that establish the following logical structures therein:

a reliable symbol detector in communication with the buffer memory to identify which of the stored captured samples are likely to be located in a correct decision region of a corresponding source symbol, ~~have been corrupted least by channel effects,~~ the identified samples being reliable symbols,

an adaptation unit in communication with the reliable symbol detector to estimate channel effects from values of the reliable symbols, and

a symbol decoder unit in communication with the adaptation unit and the buffer memory.

45. (Currently Amended) The receiver of claim 44, wherein the reliable symbol detector operates according to a method, comprising:

calculating a reliability factor of a captured sample from values of a plurality of samples proximate to the captured sample, and

if the reliability factor is less than a predetermined limit, designating the captured sample as a reliable symbol.

46. (Currently Amended) The receiver of claim 45, wherein the reliability factor R_n of the captured sample is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i\neq 0}}^{K_2} |y_{n-i}| \cdot c_i \text{, where}$$

y_n is the captured sample,

y_{n-i} is a sample in proximity to the captured sample,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

47. (Currently Amended) The receiver of claim 45, wherein the reliability of a two-dimensional captured sample y_n is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} \sqrt{y_{1_{n-i}}^2 + y_{2_{n-i}}^2} \cdot c_i \text{ , where}$$

$y_{1_{n-i}}$ and $y_{2_{n-i}}$ $\cancel{y_{1_{n-i}}^2}$ ~~and~~ $\cancel{y_{2_{n-i}}^2}$ respectively represent values of a neighboring sample y_{n-i} in first and second dimensions,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

48. (Original) The receiver of claim 44, further comprising a second buffer memory in communication with the symbol decoder.

49. (Previously Presented) A ~~transmission~~ data communication system comprising:

a source that transmits data encoded as symbols, the symbols being selected from a high-order constellation,

a destination that captures a signal representing the transmitted symbols having been corrupted by at least intersymbol interference, the destination:

identifying reliable symbols from the captured samples, reliable symbols being those captured samples that are estimated to be located in a correct decision region of their corresponding source symbols, ~~corrupted least by intersymbol interference,~~

calculating channel effects based on the reliable symbols and samples proximate thereto, and

correcting other captured samples based on the channel effects.

50. (Currently Amended) The system of claim 49, wherein reliable symbols are identified according to a method comprising:

calculating a reliability factor of a captured sample from values of a plurality of samples proximate to the captured sample, and

if the reliability factor is less than a predetermined limit, designating the captured sample as a reliable symbol.

51. (Currently Amended) The system of claim 50, wherein the reliability factor R_n of the captured sample is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} |y_{n-i}| \cdot c_i \text{, where}$$

y_n is the captured sample,

y_{n-i} is a sample in proximity to the captured sample,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

52. (Currently Amended) The system of claim 50, wherein the reliability of a two-dimensional captured sample y_n is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} \sqrt{y_{1_{n-i}}^2 + y_{2_{n-i}}^2} \cdot c_i \text{, where}$$

$y_{1_{n-i}}$ and $y_{2_{n-i}}$ ~~$y_{1_{n-i}}^2$ and $y_{2_{n-i}}^2$~~ respectively represent values of a neighboring sample y_{n-i} in first and second dimensions,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

53. (Currently Amended) A computer readable medium having stored thereon instructions that, when executed, cause a processor to identify reliable symbols from captured samples received by a system for use in communicating data via a high order constellation by a process comprising:

calculating ~~e~~ a reliability factor of a captured sample from values of a plurality of samples proximate to the captured sample; and

if the reliability factor is less than a predetermined limit, designating ~~e~~ the captured sample as a reliable symbol.

54. (Currently Amended) The medium of claim 53, wherein the reliability factor R_n of the captured sample is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} |y_{n-i}| \cdot c_i \text{, where}$$

y_n is the captured sample,

y_{n-i} is a sample in proximity to the captured sample,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

55. (Currently Amended) The medium of claim 53, wherein the reliability of a two-dimensional captured sample y_n is given by:

$$R_n = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} \sqrt{y_{1_{n-i}}^2 + y_{2_{n-i}}^2} \cdot c_i \text{ , where}$$

$y_{1_{n-i}}$ and $y_{2_{n-i}}$ ~~$y_{1_{n-i}}^2$ and $y_{2_{n-i}}^2$~~ respectively represent values of a neighboring sample y_{n-i} in first and second dimensions,

K_1, K_2 are numbers of samples adjacent to the captured sample, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

56. (Previously Presented) A computer readable medium having stored thereon instructions that, when executed, cause a processor to correct channel effects in captured samples received by a system for use in communicating data via a high order constellation by a process comprising:

identifying reliable symbols from a string of captured samples, the reliable symbols being the captured samples which are estimated to be located in a correct decision region of a corresponding source symbol, ~~have been corrupted least by channel effects,~~

calculating~~e~~ channel effects based on the reliable symbols and samples proximate thereto, and

correcting the captured samples based on the channel effects.

57. (Currently Amended) A method, for use in a communication system for transmitting symbols of a high order constellation, of decoding a string of captured samples recovered from a communication channel comprising:

identifying reliable symbols from a the string of captured samples, the reliable symbols being the captured samples which are estimated to be located in a correct decision region of a corresponding source symbol, ~~have been corrupted least by channel effects,~~

calculating channel effects based on the reliable symbols and samples proximate thereto,

estimating transmitted symbols from remaining captured samples based on the channel effects, and

outputting the estimated symbols as the a decoded data signal.

REMARKS

In the foregoing claims, the term "high order constellation" refers to transmission constellations having more than two constellation points. See, specification, ¶ 6.

EXHIBIT A

PATENT
Att'y Dkt.: 12805/46001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Confirmation No. 5466
Eilon RIESS, et al.	Examiner: K. Thangavelu
Serial No.: 09/836,281	
Filed: April 18, 2001	Art Unit: 2123
For: Reliable Symbols as a Means of Improving the Performance of Information Transmission Systems	

COMMENTS ON STATEMENT OF REASONS FOR ALLOWANCE

Mail Stop: ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

With respect to the Notice of Allowance in the above-identified application, the Examiner's Amendment fails to acknowledge that the agreements entered into with the undersigned are based on a common understanding of the term "high order constellation." As agreed to by the Examiner and applicants, high order constellation shall be interpreted to mean transmission constellations having more than two constellation points (see attached). No such acknowledgement appears in the Notice of Allowance and, therefore, this paper corrects the oversight.

If you have any questions, the Examiner is invited to contact the undersigned at (202) 220-4235.

Respectfully submitted,

Date: May 10, 2006

Robert L. Hails, Jr.
Registration No. 39,702

KENYON & KENYON LLP
1500 K Street, N.W.
Washington, D.C. 20005
Ph.: (202) 220-4200
Fax.: (202) 220-4201

607773v1

Hails, Robert

From: Hails, Robert
Sent: Tuesday, January 31, 2006 1:45 PM
To: 'Kandasamy.Thangavelu@uspto.gov'
Subject: SN09 899,843 Proposal for Examiner's Amendment.pdf
Attachments: SN09 899,843 Proposal for Examiner's Amendment.pdf

Examiner Thangavelu:

You are authorized to enter the following amendments into the above-referenced application if it would secure allowance of the application and provided you indicate in examiner's remarks that you agree to the definition provided for "high order constellation." Please call me tomorrow to indicate whether the proposal is accepted or not.

Regards,
Bob Hails

Robert L. Hails
Kenyon & Kenyon, LLP
1500 K Street, N.W.
Washington, D.C. 20005

O: +1 202 220 4235
F: +1 202 220 4201
RHails@Kenyon.com

SERIAL NO. 09/899,843: PROPOSAL FOR EXAMINER'S AMENDMENT

IN THE CLAIMS:

1. (Currently amended) A reliable symbol identification method for use in a communication system for transmitting symbols of a high order constellation, comprising:

estimating decoded symbols from a sequence of captured samples representing a communication signal captured at a receiver,

calculating a reliability factor of a candidate sample from values of a plurality of estimated symbols in proximity to an estimated symbol that corresponds to the candidate sample,

if the reliability factor is less than a predetermined limit, designating the candidate sample as a reliable symbol.

2. (Original) The method of claim 1, wherein the reliability factor R of the candidate sample x_n is given by:

$$R(x_n) = \sum_{\substack{i=-K_1 \\ i\neq 0}}^{K_2} \left|\hat{d}_{n-i}\right| \cdot c_i \text{, where}$$

$\hat{d}_{n-i}$ is an estimated symbol,

K_1, K_2 are the number of ~~decoded~~ estimated symbols adjacent to symbol $\hat{d}_n$ ~~the candidate sample~~, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

3. (Original) The method of claim 2, wherein K_1 is zero.

4. (Original) The method of claim 1,wherein the reliability of a two-dimensional candidate sample x_n is given by:

$$R(x_n) = \sum_{\substack{i=-K_1 \\ i\neq 0}}^{K_2} \sqrt{\hat{d}^2_{1_{n-i}} + \hat{d}^2_{2_{n-i}}} \cdot c_i \text{, where}$$

$\hat{d}_{1_{n-i}}$ and $\hat{d}_{2_{n-i}}$ respectively represent values of an estimated symbol $\hat{d}_{n-i}$ in first and second dimensions,

K_1, K_2 are the number of ~~samples~~ estimated symbols adjacent to symbol $\hat{d}_n$ ~~the candidate sample~~, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

5. (Original) The method of claim 1, wherein the estimating comprises:

rescattering the captured samples according to currently known ISI effects, and

generating estimated symbols from the rescattered samples according to decision regions of a governing constellation.

6. (Original) The method of claim 1, wherein the estimating comprises generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon all possible sets of surrounding transmitted symbols and the ranges of all possible ISI coefficients, for all possible values of the captured sample.

7. (Original) The method of claim 1, wherein the estimation comprises generating estimated symbols according to trellis decoding based upon all possible sets of surrounding transmitted symbols and the ranges of all possible ISI coefficients, for all possible values of the captured sample.

8. (Original) The method of claim 1, wherein the estimating comprises generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon all possible sets of surrounding transmitted symbols and the ranges of all possible ISI coefficients, and a uniform distribution of ISI coefficients for all possible values of the captured sample

9. (Original) The method of claim 1, wherein the estimation comprises generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon past symbol decisions and the ranges of all possible ISI coefficients, for all possible values of the captured sample.

10. (Currently amended) A reliable symbol identification method for use in a communication system for transmitting symbols of a high order constellation, comprising:

estimating decoded symbols from a sequence of captured samples representing a communication signal captured at a receiver,

calculating a reliability factor of a candidate sample from values of a plurality of decoded symbols in proximity to the candidate sample,

if the reliability factor is less than a predetermined limit, designating the candidate sample as a reliable symbol.

11. (Currently amended) The method of claim 10, wherein the reliability factor R of the candidate sample x_n is given by:

$$R(x_n) = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} \left|\hat{d}_{n-i}\right| \cdot c_i \text{, where}$$

$\hat{d}_{n-i}$ is a decoded symbol,

K_1, K_2 are numbers of decoded symbols adjacent to <u>symbol $\hat{d}_n$</u> ~~the candidate sample~~, and

c_i is a coefficient <u>representing any prior knowledge of intersymbol interference effects</u>.

12. (Currently amended) The method of claim 11, wherein K_1 is zero.

13. (Currently amended) The method of claim 10, wherein the reliability of a two-dimensional candidate sample x_n is given by:

$$R(x_n) = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} \sqrt{\hat{d}_{1_{n-i}}^2 + \hat{d}_{2_{n-i}}^2} \cdot c_i \text{, where}$$

$\hat{d}_{1_{n-i}}$ and $\hat{d}_{2_{n-i}}$ respectively represent values of an estimated symbol $\hat{d}_{n-i}$ in first and second dimensions,

K_1, K_2 are numbers of decoded symbols adjacent to <u>symbol $\hat{d}_n$</u> ~~the candidate sample~~, and

c_i is a coefficient <u>representing any prior knowledge of intersymbol interference effects</u>.

14. (Currently amended) The method of claim 10, wherein the estimation comprises:

rescattering the captured samples according to currently estimated ISI effects, and

generating estimated symbols from the rescattered samples according to decision regions of a governing constellation.

15. (Currently amended) The method of claim 10, wherein the estimating comprises generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon all possible sets of surrounding transmitted symbols and the ranges of all possible ISI coefficients, for all possible values of the captured sample.

16. (Currently amended) The method of claim 10, wherein the estimating comprises generating estimated symbols according to trellis decoding based upon all possible sets of surrounding transmitted symbols and the ranges of all possible ISI coefficients, for all possible values of the captured sample.

17. (Currently amended) The method of claim 10, wherein the estimating comprises generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon all possible sets of surrounding transmitted symbols and the ranges of all possible ISI coefficients, and a uniform distribution of ISI coefficients for all possible values of the captured sample

18. (Currently amended) The method of claim 10, wherein the estimating comprises generating estimated symbols according to a maximum likelihood analysis of conditional probabilities of a captured sample conditioned upon past symbol decisions and the ranges of all possible ISI coefficients, for all possible values of the captured sample.

19. (Currently amended) An equalization method for use in a communication system for transmitting symbols of a high order constellation, comprising:

estimating decoded symbols from captured samples based on a set of ISI coefficient estimates, the captured samples representing a communication signal captured at a receiver, and

revising the ISI coefficients based on the decoded symbols and corresponding received sample values, wherein the contribution of each symbol-sample pair is weighted according to reliability factor of the respective captured sample.

20. (Original) The equalization method of claim 19, wherein the weighting of a symbol-sample pair comprises:

comparing the reliability factor of a candidate sample to a threshold, and

assigning a first weight value to the symbol-sample pair if the reliability factor ~~exceeds~~ is less than or equal to the threshold, and

otherwise, assigning a second weight value to the symbol-sample pair.

21. (Original) The equalization method of claim 19, wherein the weighting of a symbol-sample pair is inversely proportional to the reliability factor of the candidate sample.

22. (Currently amended) The equalization method of claim 19, wherein the weighting of a candidate sample comprises:

comparing the reliability factor of the candidate sample to a threshold, and

assigning a first weight value to the symbol-sample pair if the reliability factor ~~exceeds~~ is less than or equal to the threshold, and

otherwise, assigning a second weight value to the symbol-sample pair, the second weight being inversely proportional to the reliability factor of the candidate sample.

23. (Canceled).

24. (Original) The equalization method of claim 19, wherein the reliability factor of a candidate sample x_n is determined from values of neighboring samples.

25. (Original) The equalization method of claim 24, wherein the reliability factor R of a candidate sample x_n is given by:

$$R(x_n) = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} |x_{n-i}| \cdot c_i \text{ , where}$$

x_{n-i} is a value of a surrounding sample,

K_1, K_2 represent numbers of samples adjacent to sample x_n, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

26. (Original) The equalization method of claim 24, wherein the reliability factor R of a candidate sample x_n is given by:

$$R(x_n) = \sum_{i=1}^{K} |x_{n-i}| \cdot c_i \text{ , where}$$

x_{n-i} is a value of a surrounding sample,

K represents a number of samples neighboring to sample x_n, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

27. (Original) The equalization method of claim 24, wherein the reliability factor R of a candidate sample x_n is given by:

$$R(x_n) = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} \sqrt{x_{1_{n-i}}^2 + x_{2_{n-i}}^2} \cdot c_i \text{, where}$$

$x_{1_{n-i}}$ and $x_{2_{n-i}}$ respectively represent values of a captured sample x_{n-i} in first and second dimensions,

K_1, K_2 represent numbers of samples neighboring to sample x_n, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

28. (Original) The method of claim 27 where $K_1 = 0$.

29. (Original) The equalization method of claim 19, wherein the reliability factor of a candidate sample x_n is determined from values of estimated symbols $\hat{d}_{n-i}$ neighboring the candidate sample.

30. (Original) The equalization method of claim 29, wherein the reliability factor R of a candidate sample x_n is given by:

$$R(x_n) = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} \left|\hat{d}_{n-i}\right| \cdot c_i \text{, where}$$

$\hat{d}_{n-i}$ is a value of an estimated symbol,

K_1, K_2 represent numbers of estimated symbols ~~samples~~ neighboring to symbol $\hat{d}_n$ ~~sample x_n~~, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

31. (Original) The equalization method of claim 29, wherein the reliability factor R of a candidate sample x_n is given by:

$$R(x_n) = \sum_{i=1}^{K} \left|\hat{d}_{n-i}\right| \cdot c_i \text{, where}$$

$\hat{d}_{n-i}$ is a value of an estimated symbol,

K represents a number of estimated symbols ~~samples~~ neighboring to symbol $\hat{d}_n$ ~~sample x_n~~, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

32. (Original) The equalization method of claim 29, wherein the reliability factor R of a candidate sample x_n is given by:

$$R(x_n) = \sum_{\substack{i=-K_1 \\ i\neq 0}}^{K_2} \sqrt{\hat{d}^2_{1_{n-i}} + \hat{d}^2_{2_{n-i}}} \cdot c_i \text{, where}$$

$\hat{d}_{1_{n-i}}$ and $\hat{d}_{2_{n-i}}$ respectively represent values of an estimated symbol $\hat{d}_{n-i}$ in first and second dimensions,

K_1, K_2 represent numbers of ~~samples~~ estimated symbols neighboring to symbol $\hat{d}_n$ ~~sample x_n~~, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

33. (Original) The method of claim 32 where $K_1 = 0$.

34. (Original) The equalization method of claim 19, wherein the estimating comprises:

rescattering the captured samples according to the set of ISI coefficient estimates,

estimating symbols from the rescattered samples according to decision regions of a governing constellation.

35. (Original) The equalization method of claim 34,wherein the reliability factor R of a candidate sample x_n is given by:

$$R(x_n) = \sum_{\substack{i=-K_1 \\ i\neq 0}}^{K_2} |y_{n-i}| \cdot c_i \text{, where}$$

y_{n-i} is a value of a rescattered sample,

K_1, K_2 represent numbers of rescattered samples neighboring to rescattered sample ~~x~~y_n, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

36. (Original) The equalization method of claim 34, wherein the reliability factor R of a candidate sample x_n is given by:

$$R(x_n) = \sum_{i=1}^{K} |y_{n-i}| \cdot c_i \text{, where}$$

y_{n-i} is a value of a rescattered sample,

K represents a number of rescattered samples neighboring to rescattered sample y_n ~~sample x_n~~, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

37. (Original) The equalization method of claim 34, wherein the reliability factor R of a candidate sample x_n is given by:

$$R(x_n) = \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} \sqrt{y_{1_{n-i}}^2 + y_{2_{n-i}}^2} \cdot c_i \text{, where}$$

$y_{1_{n-i}}$ and $y_{2_{n-i}}$ respectively represent values of a rescattered sample y_{n-i} in first and second dimensions,

K_1, K_2 represent numbers of rescattered samples neighboring to rescattered sample y_n~~sample x_n~~, and

c_i is a coefficient representing any prior knowledge of intersymbol interference effects.

38. (Currently amended) The equalization method of claim 19, wherein the estimation comprises generating decoded symbols according to a computational approximation of:

$$\Pr\left(x_n \mid h_n^k\right) = \sum_{D_{n+K_1}^{n-K_2}} \int_{\underline{a}} \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{\left(x_n - \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} a_i h_{n-i} - h_n^k\right)^2}{2\sigma^2}} \Pr(\underline{a}) \Pr\left(D_{n+K_1}^{n-K_2}\right) d\underline{a} \text{, where}$$

h_n^k represents a k^{th} estimate of the captured sample x_n,

k is an index running from a first value $-K_1$ to a second value K_2,

$D_{n+K_1}^{n-K_2} = \{h_{n+K_1}, \ldots, h_{n+1}, h_{n-1}, \ldots, h_{n-K_2}\}$,

σ^2 represents a variance in channel noise, and

$\Pr(\underline{a})$ is a probability density function of the ISI coefficients a_i.

39. (Original) The equalization method of claim 19, wherein the estimating and the revising operate on captured samples and estimated symbols on a frame-by-frame basis.

40. (Original) The equalization method of claim 39, wherein the frames each contain a uniform number of captured samples and estimated symbols.

41. (Original) The equalization method of claim 39, further comprising:

designating captured samples as reliable symbols based on the captured samples' reliability factors, and

assembling a frame to include a set of captured samples and a set of reliable symbols from a preceding frame.

42. (Original) The equalization method of claim 39, further comprising:

designating captured samples as reliable symbols based on the captured samples' reliability factors, and

assembling a frame to include a set of captured samples and a set of reliable symbols from multiple preceding frames.

43. (Original) The equalization method of claim 39, wherein frame lengths vary according to a regular progression of predetermined lengths.

44. (Original) An equalizer for use in a communication system for transmitting symbols of a high order constellation, comprising:

a symbol decoder having a first input for captured samples, a second input for estimated ISI coefficients and an output for estimated symbols,

an ISI estimator having a first input coupled to the symbol decoder output, a second input coupled to the first input of the symbol decoder and an output for the estimated ISI coefficients, wherein the ISI estimator estimates ISI coefficients based on the decoded symbols and corresponding received sample values, each symbol-sample pair being weighted according to reliability factor of the respective captured sample.

45. (Original) The equalizer of claim 44, wherein the symbol decoder comprises a subtractive equalizer coupled to a decision unit.

46. (Original) The equalizer of claim 44, wherein the symbol decoder comprises a maximum likelihood estimator coupled to a decision unit.

47. (Original) The equalizer of claim 46, wherein the maximum likelihood analysis is made having assigned a uniform probability distribution for ISI coefficients over their ranges.

48. (Original) The equalizer of claim 46, wherein the maximum likelihood analysis is made having assigned previously decoded symbols to occur with probability equal to one.

49. (Original) The equalizer of claim 44, wherein the symbol decoder comprises a trellis decoder coupled to a decision unit.

50. (Currently amended) The equalizer of claim 44, wherein the symbol decoder generates decoded symbols according to a computational approximation of:

$$\Pr\left(x_n \mid h_n^k\right) = \sum_{D_{n+K_1}^{n-K_2}} \int_{\underline{a}} \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{\left(x_n - \sum\limits_{\substack{i=-K_1 \\ i\neq 0}}^{K_2} a_i h_{n-i} - h_n^k\right)^2}{2\sigma^2}} \Pr(\underline{a}) \Pr\left(D_{n+K_1}^{n-K_2}\right) d\underline{a}$$

where,

h_n^k represents a k^{th} estimate of the captured sample x_n,

k is an index running from a first value $-K_1$ to a second value K_2,

$D_{n+K_1}^{n-K_2} = \{h_{n+K_1}, \ldots, h_{n+1}, h_{n-1}, \ldots, h_{n-K_2}\}$,

σ^2 represents a variance in channel noise, and

$\Pr(\underline{a})$ is a probability density function of the ISI coefficients a_i.

51. (Original) The equalizer of claim 44, further comprising a reliable symbol detector having an input coupled to the first input of the symbol decoder and an output that enables the symbol decoder.

52. (Currently amended) A receiver for use in a communication system for transmitting symbols of a high order constellation, comprising:

a demodulator to generate captured samples from a communication signal received via a channel,

a memory system coupled to the demodulator, the memory system logically organized as a captured sample buffer and a decoded symbol buffer, and

a processor coupled to the memory by a communication path, the processor logically organized as a reliable symbol detector, an ISI estimator and a symbol decoder, the reliable symbol detector to identify which of the captured samples are likely to be located within a correct decision region of a constellation notwithstanding ISI effects of the channel, the ISI estimator to estimate the ISI effects based on the symbols so identified by the reliable symbol detector, and the symbol decoder to generate decoded symbols from the captured samples in response to the estimated ISI effects.

53. (Original) The receiver of claim 52, wherein the symbol decoder is embodied as a subtractive equalizer coupled to a decision unit.

54. (Original) The receiver of claim 52, wherein the symbol decoder is embodied as a maximum likelihood estimator.

55. (Original) The receiver of claim 54, wherein the maximum likelihood estimator assigns a uniform probability distribution for ISI coefficients over their ranges.

56. (Original) The receiver of claim 54, wherein the maximum likelihood estimator assigns to occurrence of previously decoded symbols a probability of occurrence equal to one.

57. (Original) The receiver of claim 52, wherein the symbol decoder is embodied as a trellis decoder.

58. (Currently amended) The receiver of claim 52, wherein the symbol decoder generates decoded symbols according to a computational approximation of:

$$\Pr\left(x_n \mid h_n^k\right) = \sum_{D_{n+K_1}^{n-K_2}} \int_{\underline{a}} \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{\left(x_n - \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} a_i h_{n-i} - h_n^k\right)^2}{2\sigma^2}} \Pr(\underline{a}) \Pr\left(D_{n+K_1}^{n-K_2}\right) d\underline{a}, \text{ where}$$

h_n^k represents a k^{th} estimate of the captured sample x_n,

k is an index running from a first value $-K_1$ to a second value K_2,

$D_{n+K_1}^{n-K_2} = \{h_{n+K_1}, \ldots, h_{n+1}, h_{n-1}, \ldots, h_{n-K_2}\}$,

σ^2 represents a variance in channel noise, and

$\Pr(\underline{a})$ is a probability density function of the ISI coefficients a_i.

59. (Original) A computer readable medium having instructions stored thereon that, when executed by processing unit, causes ~~the following~~ <u>a symbol estimation</u> method to be executed <u>in a communication system for transmitting symbols of a high order constellation</u>:

estimating decoded symbols from a sequence of captured samples and a set of estimated ISI coefficients, and

revising the estimated ISI coefficients based on the decoded symbols and corresponding received sample values, wherein a contribution of each symbol-sample pair to the revision is weighted according to reliability factors of the respective captured sample.

60. (Original) The medium of claim 59, wherein the weighting of a symbol-sample pair comprises:

comparing the reliability factor of a candidate sample to a threshold, and

assigning a first weight value to the symbol-sample pair if the reliability factor ~~exceeds~~ is less than or equal to the threshold, and

otherwise, assigning a second weight value to the symbol-sample pair.

61. (Original) The medium of claim 59, wherein the weighting of a symbol-sample pair is inversely proportional to the reliability factor of the candidate sample.

62. (Original) The medium of claim 59, wherein the weighting of a candidate sample comprises:

comparing the reliability factor of the candidate sample to a threshold, and

assigning a first weight value to the symbol-sample pair if the reliability factor ~~exceeds~~ is less than or equal to the threshold, and

otherwise, assigning a second weight value to the symbol-sample pair, the second weight being is inversely proportional to the reliability factor of the candidate sample.

63. (Original) The medium of claim 59, wherein the reliability factor of a candidate sample is determined from values of samples neighboring the candidate sample.

64. (Original) The medium of claim 59,wherein the reliability factor of a candidate sample x_n is determined from values of estimated symbols $\hat{d}_{n-i}$ neighboring the n^{th} estimated symbol.

65. (Original) The medium of claim 59, wherein the estimating comprises:

rescattering the captured samples according to the set of ISI coefficients,

estimating symbols from the rescattered samples according to decision regions of a governing constellation.

66. (Original) The medium of claim 59, wherein the estimating comprises:

rescattering the captured samples according to currently known ISI effects, and

generating estimated symbols from the captured samples according to decision regions of a governing constellation.

67. (Currently amended) The medium of claim 59, wherein the estimating comprises generating decoded symbols according to a computational approximation of:

$$\Pr\left(x_n \mid h_n^k\right) = \sum_{D_{n+K_1}^{n-K_2}} \int_{\underline{a}} \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{\left(x_n - \sum_{\substack{i=-K_1 \\ i \neq 0}}^{K_2} a_i h_{n-i} - h_n^k\right)^2}{2\sigma^2}} \Pr(\underline{a}) \Pr\left(D_{n+K_1}^{n-K_2}\right) d\underline{a}, \text{ where}$$

h_n^k represents a k^{th} estimate of the captured sample x_n,

k is an index running from a first value $-K_1$ to a second value K_2,

$D_{n+K_1}^{n-K_2} = \{h_{n+K_1}, \ldots, h_{n+1}, h_{n-1}, \ldots, h_{n-K_2}\}$,

σ^2 represents a variance in channel noise, and

$\Pr(\underline{a})$ is a probability density function of the ISI coefficients a_i.

68. (Original) The medium of claim 59, wherein the estimating and the revising operate on frames of captured samples and estimated symbols on a frame-by-frame basis.

69-72. (Canceled).

73. (Original) A framing method <u>for use in a communication system for transmitting symbols of a high order constellation</u>~~for communication processing system~~, comprising:

identifying reliable symbols from a first frame of captured samples,

following processing of the first frame, generating a second frame of captured samples, the second frame comprising the reliable samples from the first frame and a second set of captured samples<u>, wherein the identifying comprises:</u>

<u>estimating decoded symbols from a sequence of captured samples representing a communication signal captured at a receiver,</u>

<u>calculating a reliability factor of a candidate sample from values of a plurality of estimated symbols in proximity to an estimated symbol that corresponds to the candidate sample,</u>

<u>if the reliability factor is less than a predetermined limit, designating the candidate sample as a reliable symbol</u>.

74. (Original) The framing method of claim 73, further comprising:

identifying reliable symbols from the second frame of captured samples, and

assembling a third frame from a third set of captured samples and the reliable symbols from the second frame.

75. (Original) The framing method of claim 74, wherein the third set also includes reliable symbols from the third frame.

REMARKS

In the foregoing claims, the term "high order constellation" refers to transmission constellations having more than two constellation points. See, specification, ¶ 5.